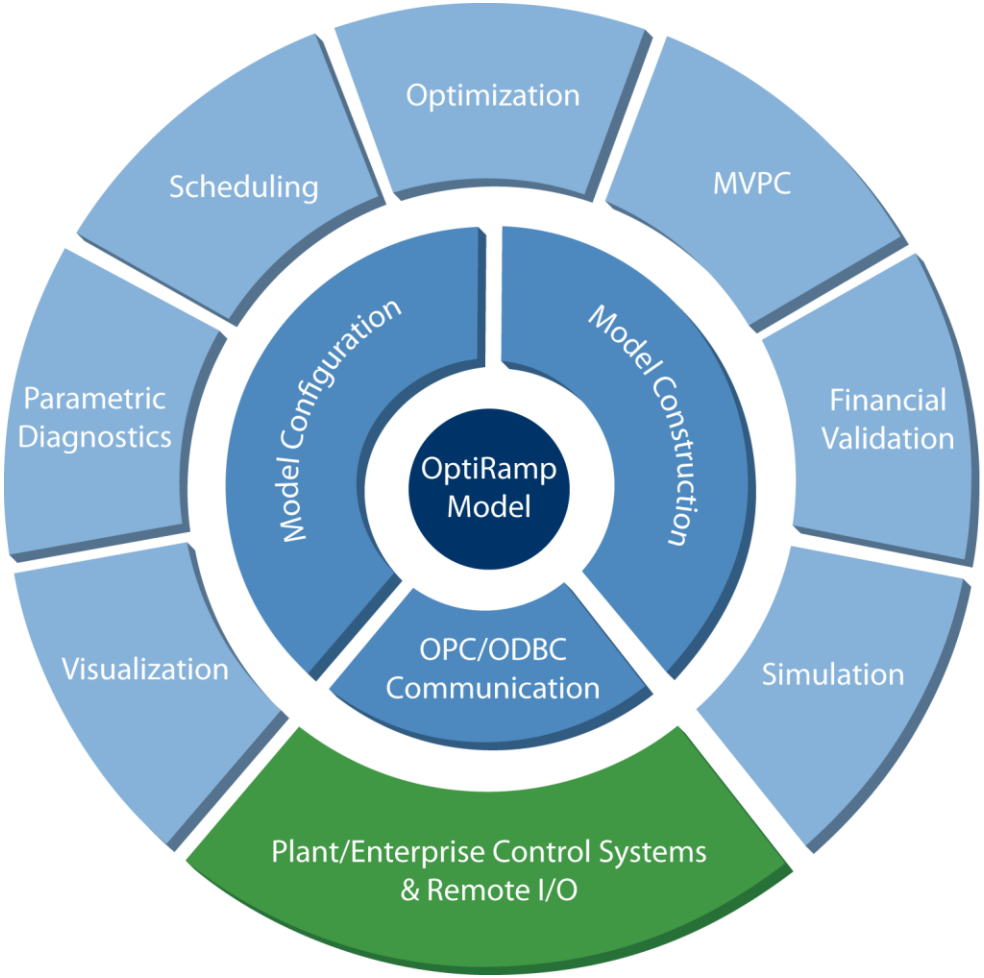
Statistics & Control, Inc.

Simulation-Based Dispatch of Power Generation

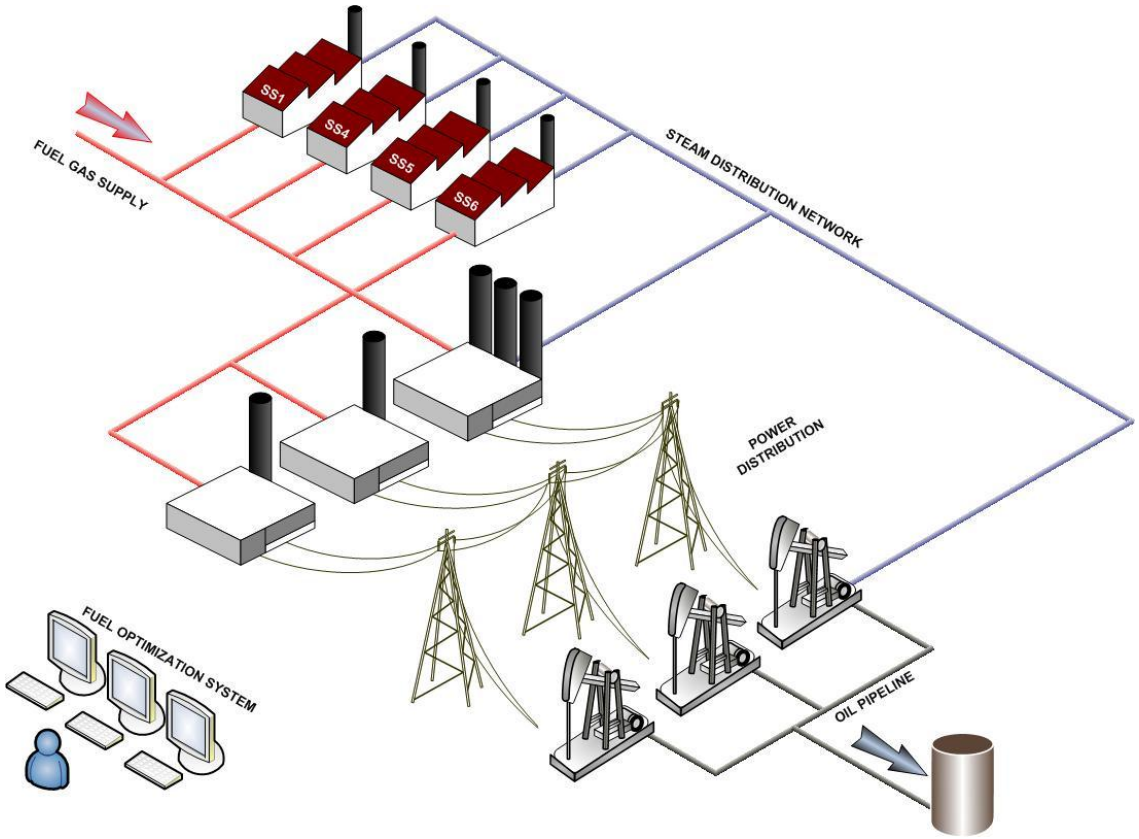
Advanced Process Control

- Optimization technique increases process efficiency while maintaining emissions; reduces fuel consumption, and a number of other cost-impacting factors. It provides real-time set points to control system to optimize the distribution of load demands across multiple units and determines the optimum amount of operating units. APC finds the most economic set-points.
- Advanced Regulatory Control technique improves process stability, allowing operation closer to target, constraint and optimum values found by Optimization module. It consists of model-based predictive control and adaptive control. APC finds the most optimum response to changing requirements.
- Diagnostic technique also performs analytical functions by analyzing variables as function of time to monitor degradation of equipment. It allows implementing predictive maintenance scheduling based on equipment state VS planned maintenance. APC reduces maintenance and ensures longer equipment life.
- Scheduling technique builds process operating forecast in accordance with planned production. It optimizes the distribution of load demands across multiple units or unit components through a cost-based function VS time. The operating forecast that considers dynamically generated efficiency information can be scaled to meet the production needs and in the same time to reduce operating costs and emissions, to improve profitability. APC finds the most economic operating schedule.



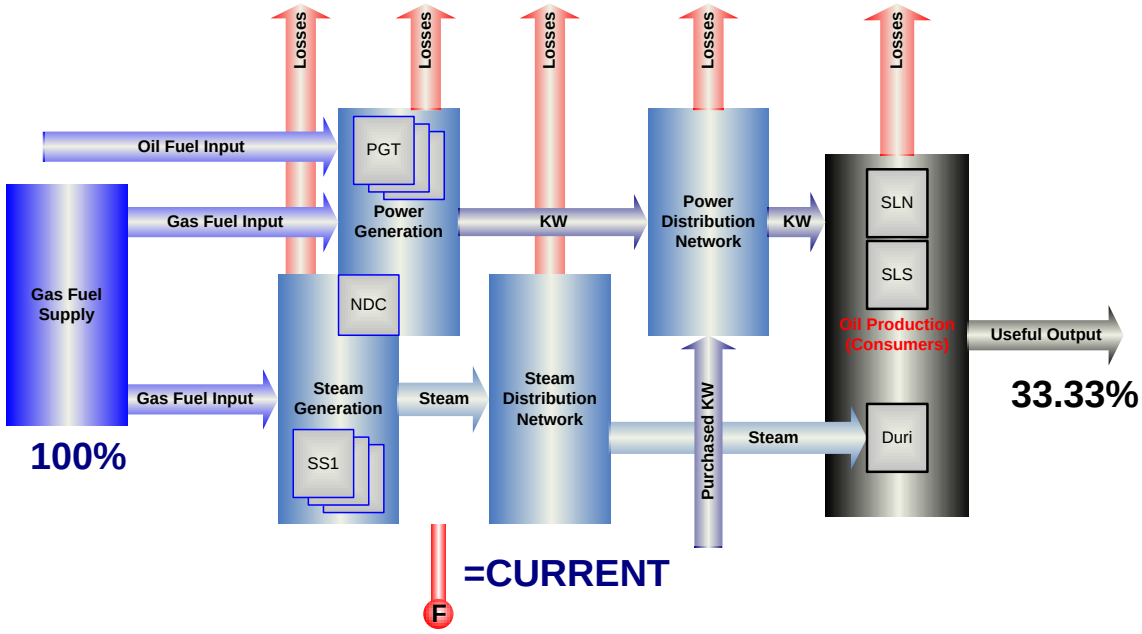
Steam Flood Operation

- Assistance in achieving optimal operation by accurately responding to real time demands and limitations.
- Process optimization to maximize oil throughput and reduce energy consumption in meeting delivery commitments.
- Enhanced companies' ability to manage data and make better operating and prospecting decisions.
- Improving process stability, allowing operation closer to target, constraint and optimum values.
- Forecasting, process simulation, determining the ability to meet obligations.



Material & Energy Balance Model

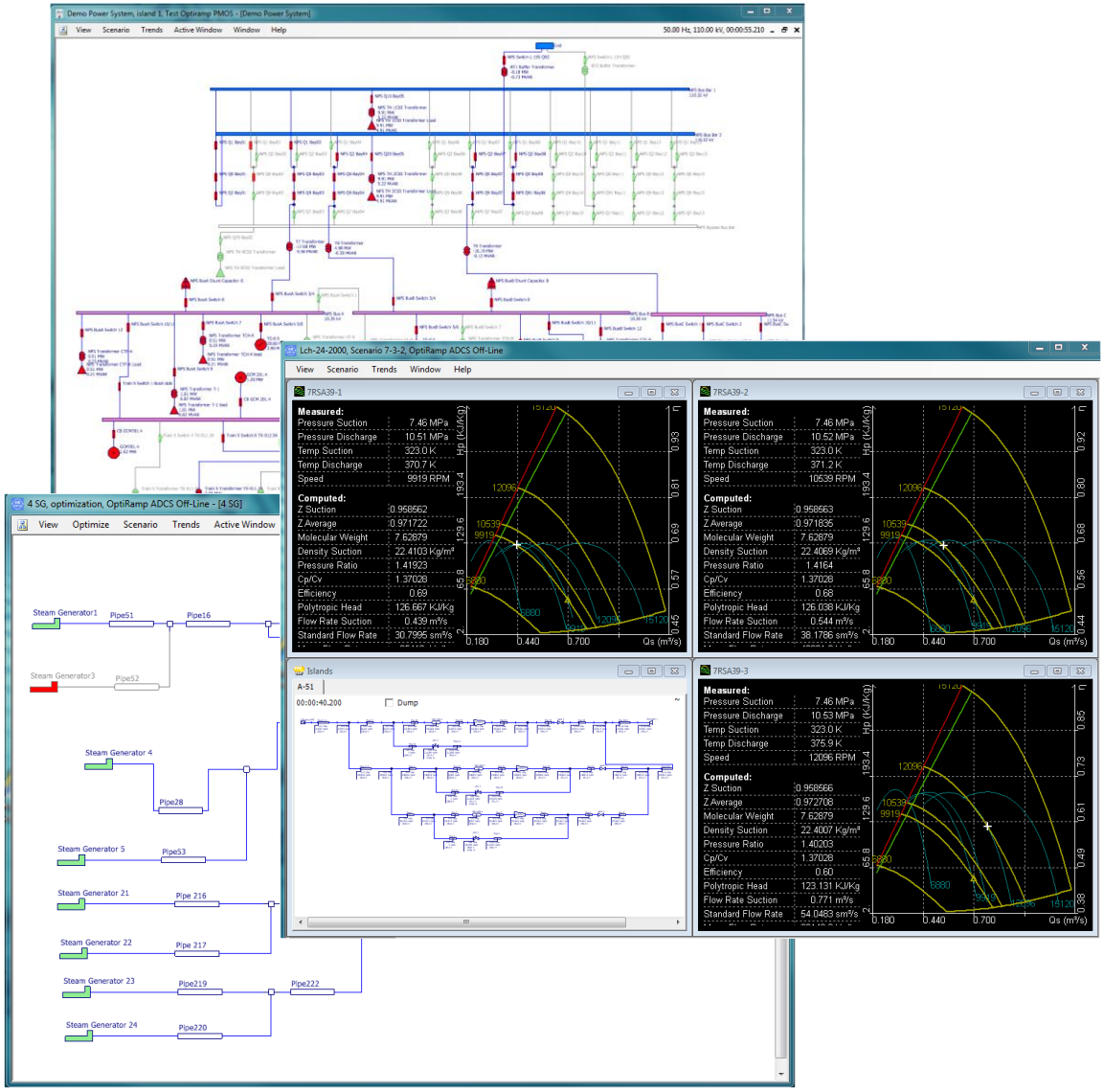
- Energy quantities is described by energy balance model, which is statement on the conservation of energy.
- Material quantities, as they pass through processing operations, is described by material balance model. Such balances are statements on the conservation of mass.
- These models represent functional dependencies between various inputs, outputs, and losses so that optimization application can used for finding improvements in real time mode.
- Each operation is represented as a box. The mass and energy going into the box must balance with the mass and energy coming out.
- In continuous processes, time also enters into consideration and the balances are related to units dynamics.



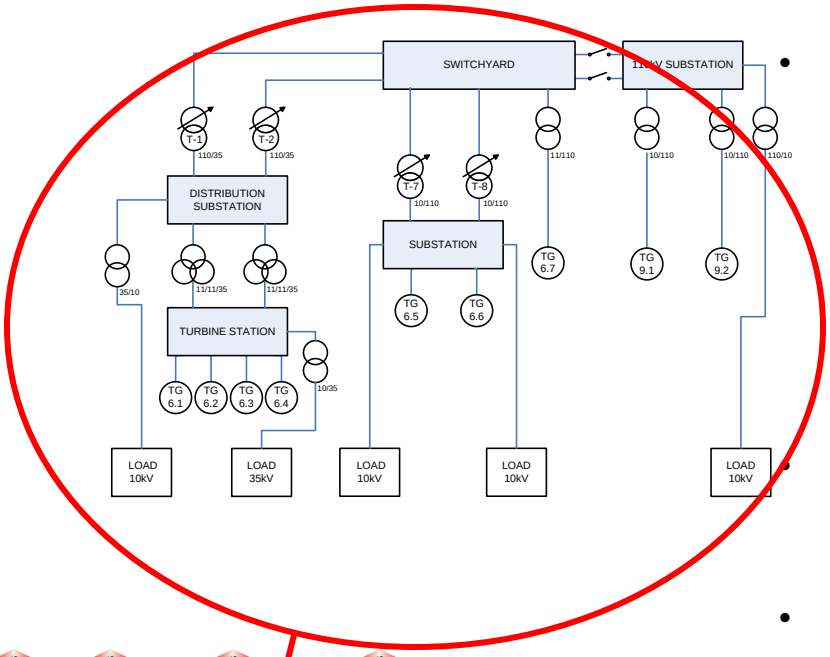
Hydraulic and Electrical Models

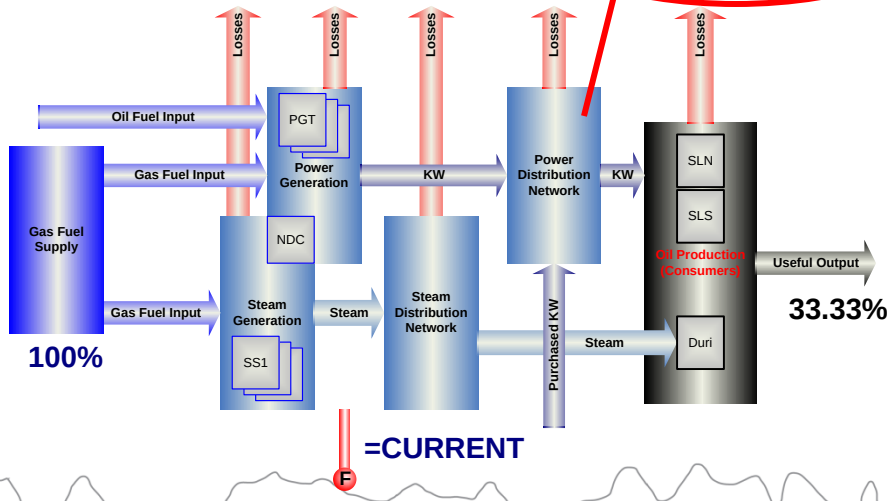
Automatic Modeling is the process of finding correlations or patterns among numerous elements in large relational datasets.

The OptiRamp® Model Construction **Module** identifies mathematical dependencies between various process variables. The Model Construction Module collects processed data and converts it into static and dynamic models. It analyzes responses of one process variable as a function of one or more process independent variables. The OptiRamp® system uses a statistical method for model construction. It is based on recording the controlled variable values under normal operating conditions. A statistical method of identifying dynamic characteristics of a continuous process possesses a wide range of possible applications during the course of normal operating conditions, which allows identifying the behavior of complex systems with a large number of variables. OptiRamp® system builds each component model relative to a reference manufacturer predicted performance characteristics.



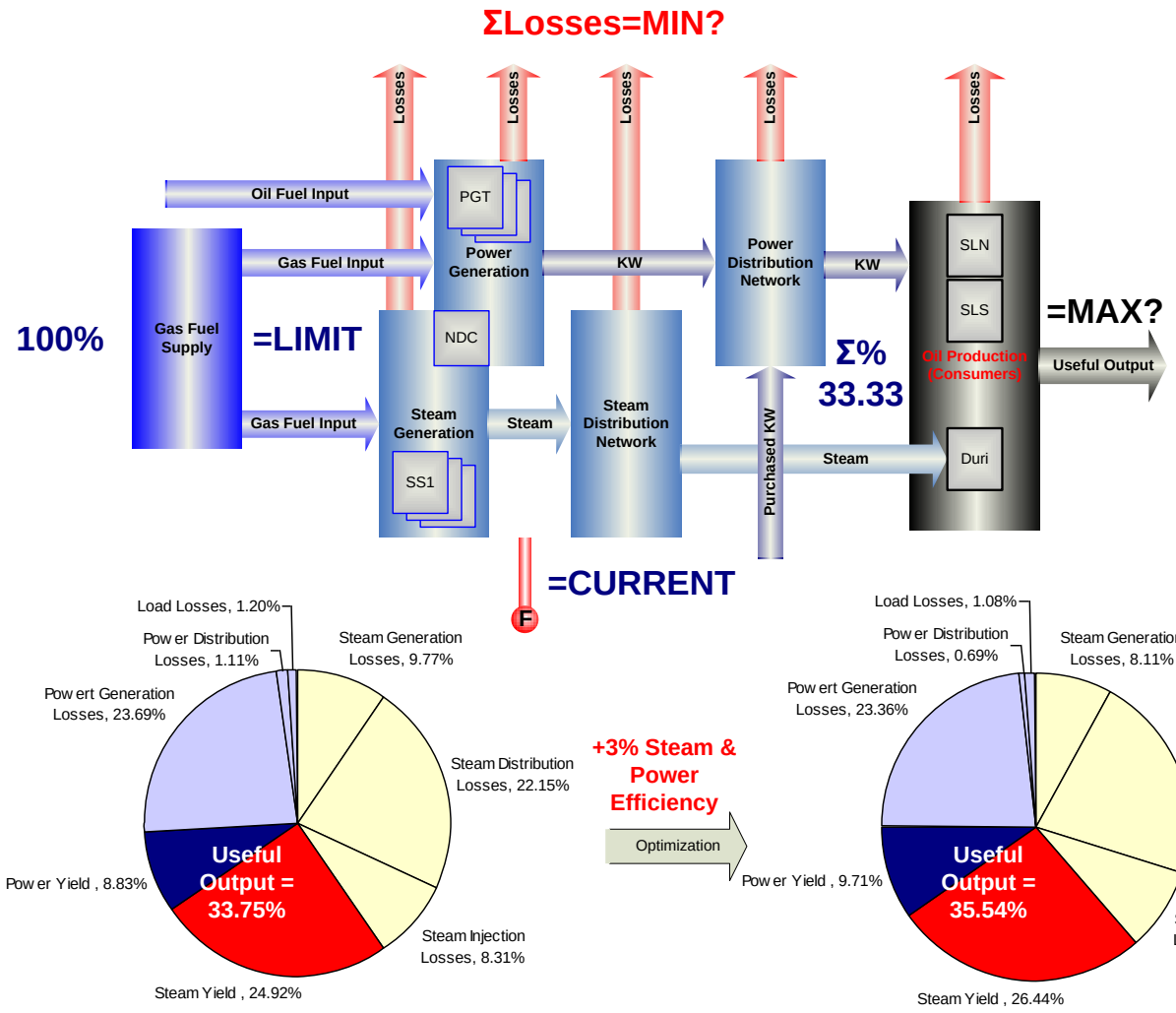
Material & Energy Balance Model





- The energy in the overall facility can be split up into various forms such as:
  - Electrical energy, which is purchased.
  - Generated electricity produced by own power plants.
  - Fuels such as furnace oil, gas are purchased and then converted into steam or electricity.
  - Boiler generates steam for heating demand
- All energy/utility system can be classified into three areas like generation, distribution and utilization for the system modeling approach and energy analysis.
- Each operation is represented as a box of interconnected sub models. For example, The Power generation Model includes all substations, lines, transformers, load, and generation models. The power grid is represented as a set of buses interconnected with lines and other elements (generators, transformers, loads, and motors) are directly connected to buses or lines.

Optimization System

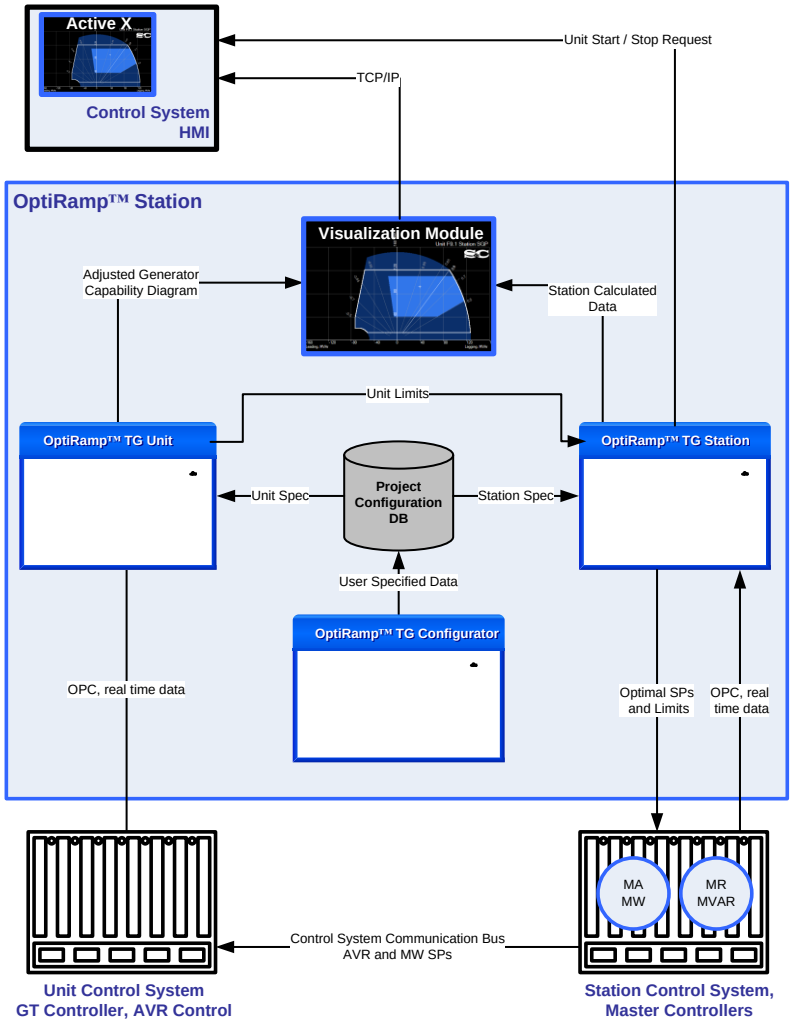


- The increasing cost of energy has caused Company to examine recourses of reducing energy consumption in processing.
- Energy balance model is used in the real time examination and optimization of the various stages of a process and overall process.
- The proposed system can reduce energy costs and increase production significantly. Company can achieve at least 4-8% reduction in cost and/or increase in productivity.

Software Architecture

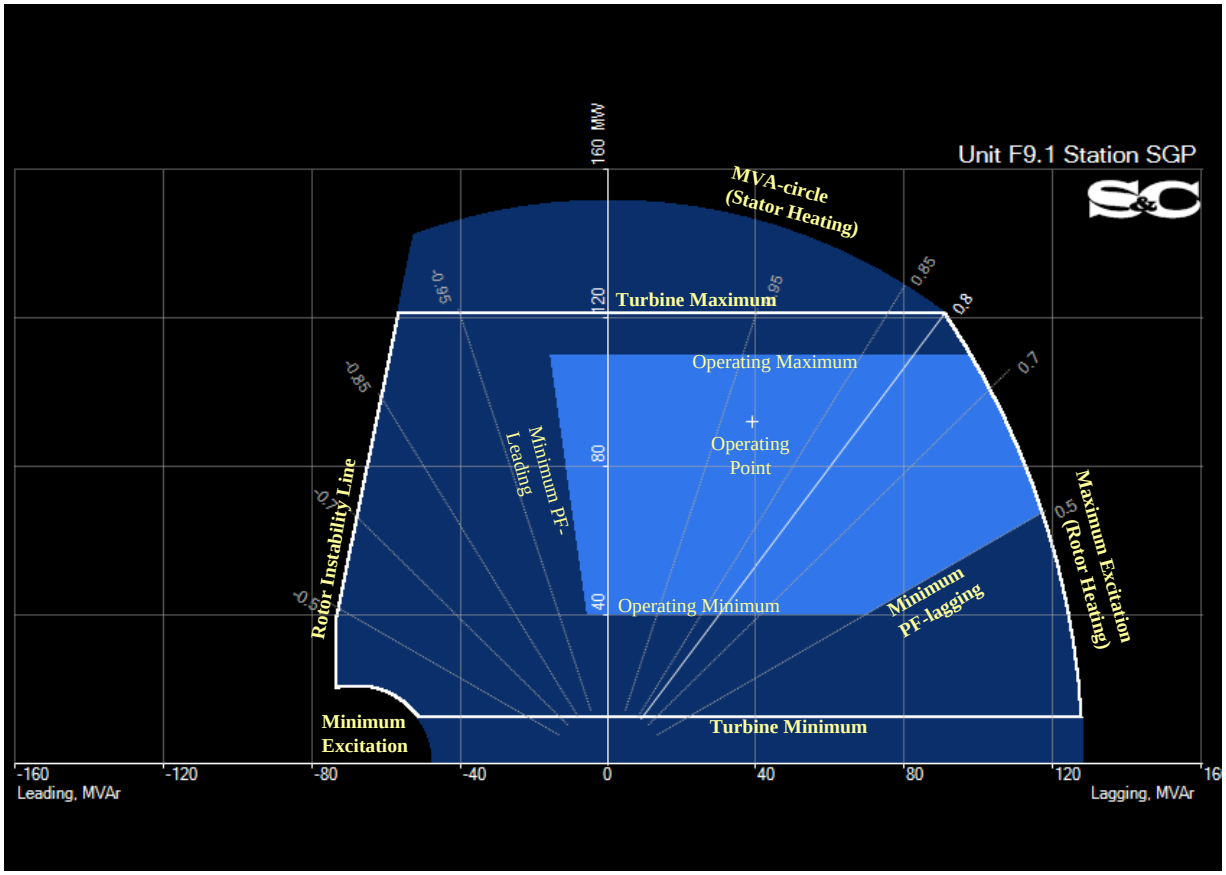
•Master Controllers comprise a Honeywell-based control system incorporated as an internal part of the DCS program. Master Controllers measurable variables are inputted directly into the system using standard DCS/PLC I/O cards. The tuning parameters are displayed and adjusted from a standard HMI screen. The communications tasks are handled by a standard DCS/PLC module, which increases data throughput and simplifies network integration.

•The computation applications are an upper-level of a control system where calculation software is installed on a separate computers, which is connected to the controllers via a common bus using standard OPC communication protocols.



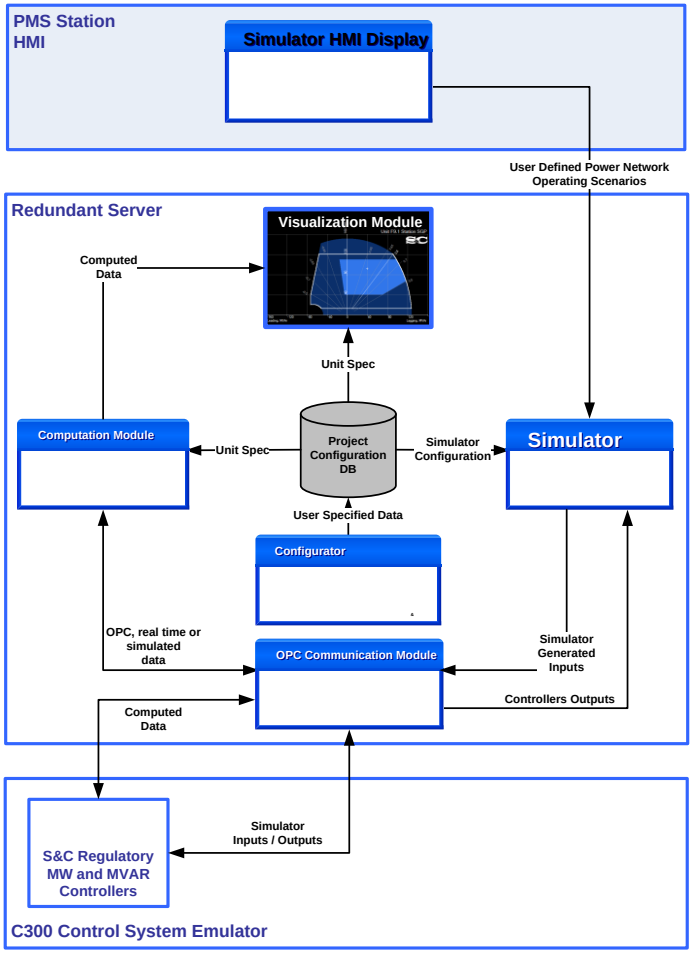
Unit Visualization Module, generator capability diagram

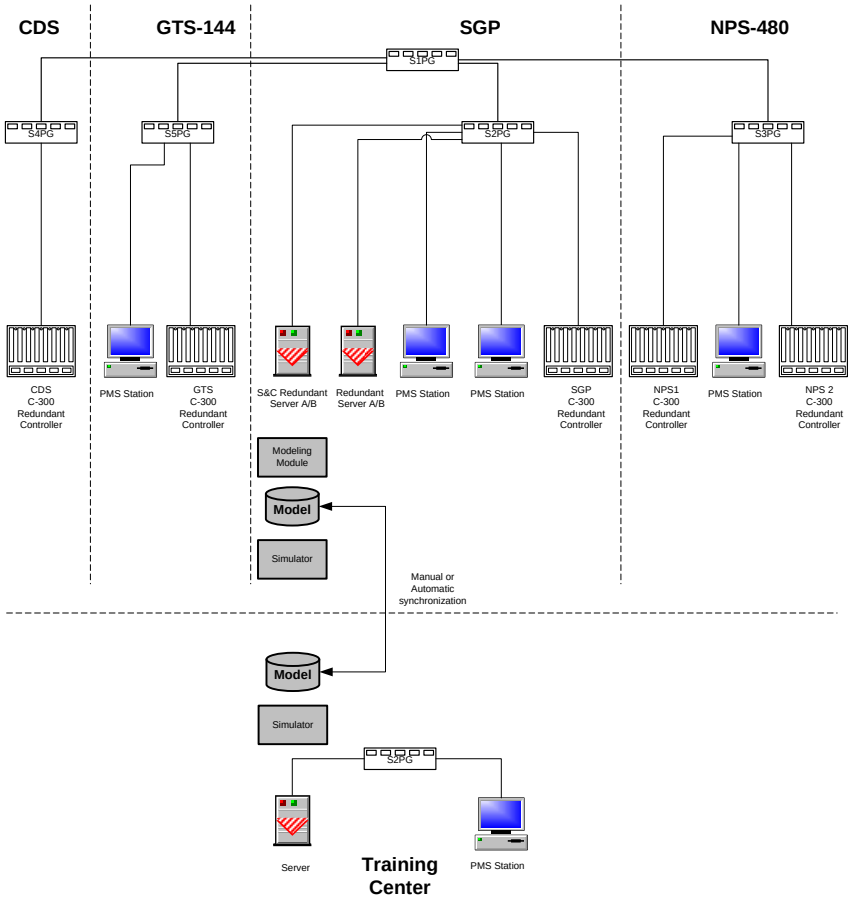
The generator capability diagram displays an operating envelope, showing the location of generator operating point (as a plus sign) in relation to the constraints. The generator capability diagram contains the number of constructed limiting lines which are based on manufacturer supplied data.



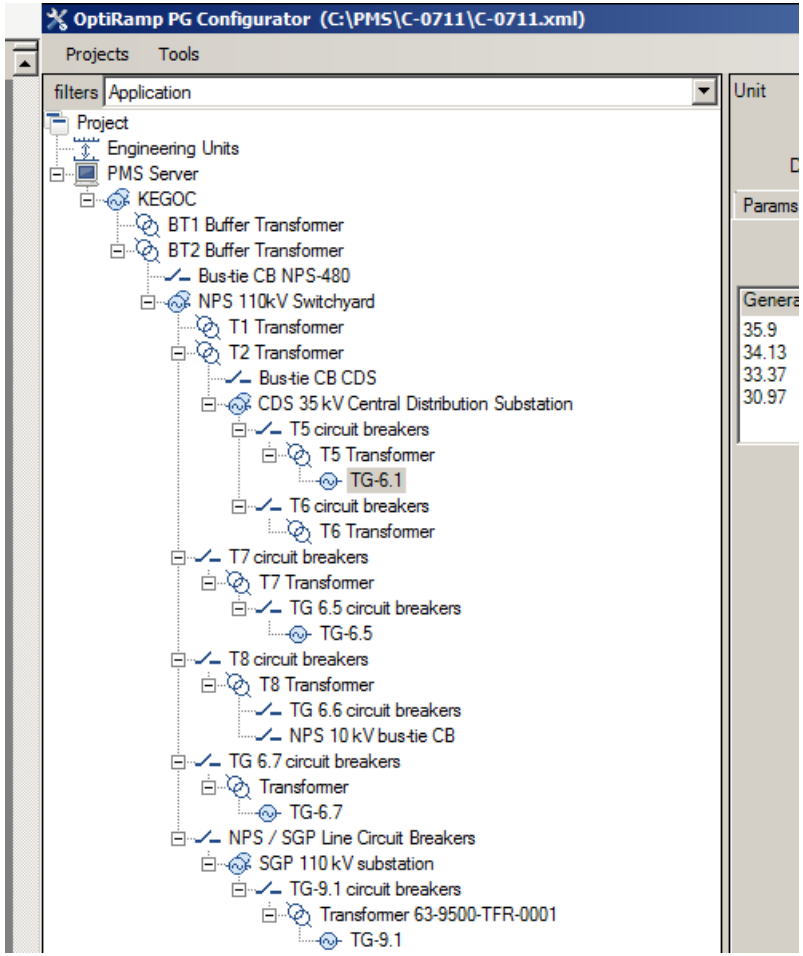
Statistics & Control, Inc.

Dynamic Simulation





Configuration Module



The Configuration Module is a powerful, intuitive, and effective user interface. It uses full Windows XP capabilities. The Module ensures

- Painless interaction with other software modules;
- Intuitive and simple design allows complete system engineering using just one module;

The manufacturer's turbine, boiler, and other equipment specification data can be set during project configuration phase using configuration module.